SIO Shipboard Meteorological Sensor Specifications

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1. General information

SIO vessels are generally outfitted with the following Meteorological sensors:
Air Temperature
Barometric Pressure
Relative Humidity
Wind Speed/Direction
Long Wave Radiation
Short Wave Radiation
Precipitation
Sea Surface Temperature
*Thermosalinograph

On R/V Revelle and R/V Melville additional sensors located in the lab measure underway oxygen and fluorometer.

The meteorological sensors used on SIO vessels are unmodified from the original manufacturers specifications with the exception of the installation of a common type of connector. This allows the sensors to be interchangeable between all SIO ships so that the sensors can be easily replaced and periodically rotated between ship and shore for maintenance/calibrations.

Depending on the make and model of the sensor the data output may be RS485, RS232 or analog signal out.

The mast junction box that is installed on each ship is designed to accommodate sensors of different output types. There are also provisions for expansion to support specific science expedition requirements.

MET Sensors are calibrated at a 6-12 months periodicity. Sensor accuracy and calibration specifications as listed are valid if the sensors are in good working order and have been calibrated within the past six months.

All sensor tolerance and accuracy values listed in this document are taken from the manufacturers specification sheets. They are derived under laboratory conditions and do not necessarily indicate the accuracies that may be expected in actual shipboard installations. They do not take into account the effects of ship roll, pitch, sway, solar radiation, shipboard structural interference and thermal radiation effects of the ship itself. These effects have not been determined and will vary from ship to ship. Placing the sensors forward on the ship and as high as possible minimizes some of the ship structural radiation effects. This is the case on R/V Revelle and R/V Melville, which has a bow, mounted MET mast.

* Installed upon request prior to cruise (R/V New Horizon, R/V Sproul).

2. Meteorological Sensors used on SIO vessels

Type	MFG	Model	Range	Accuracy	Output
Air Temperature	RM Young	41342LC	-50.0 to +50.0 C	+/- 0.3 Deg C	4-20 ma
Air Temperature	RM Young	41342VC	-50.0 to +50.0 C	+/- 0.3 Deg C	0 – 1 Volts
Precipitation	RM Young	50202	0-50 mm	+/- 1.0 mm	0 - 5 Volts
Wind	RM Young	05103	Dir 0-360 Deg Spd 0-60 m/s	+/- 3.0 Deg +/- 0.3 m/s	Voltage Out Pulse Count
Wind	Vaisala	WS425	Dir 0-360 Deg Spd 0-65 m/s	+/- 2.0 Deg +/- 0.14 m/s	RS232
Humidity/Temp	Rotronics	MP101A	RH 0-100% Tmp –40 to +60 DegC	+/- 1.5% +/- 0.2 Deg C	0 – 1 VDC -0.4 - 0.6 VDC
Humidity/Temp	Vaisala	HMP45A	RH 0-100% Tmp –40 to +60 C	+/-1.0% +/- 0.2 Deg C	0 – 1 VDC 0 – 1 VDC
Barometer	Air Inc.	DB-2A	800-1060mb	+/- 0.5 mb	RS232
Barometer	Vaisala	PTB100A	800-1060mb	+/- 0.3 mb	0 – 5.0VDC
Barometer	Vaisala	PTB101C	900-1100 mb	+/- 0.3 mb	0 - 2.5VDC
Radiometer Long Wave	Eppley	PIR Pyrgeometer	3.5-50 um 4 uv/W/M2 Response Time 2sec	+/- 1% Linearity	0 – 10mv
Radiometer Short Wave	Eppley	PSP Pyranometer	285-2800nm 9 uv/W/M2 Response Time 1sec	+/- 0.5% Linearity	0 – 100mv
Radiometer Black&White	Eppley	8-48	285-2800nm 10 uv/W/M2	+/- 1% Linearity	0 – 100mv
Radiometer Short Wave	Zipp&Zonen	CM21 Pyranometer	305-2800nm 7-25uv/W/M2 Response Time 5sec	+/- 0.25% Linearity	0 – 100mv
Radiometer Long Wave	Zipp&Zonen	CG4 Pyrgeometer	4.5-42 um 10 uv/W/M2 Response Time 25sec	+/- 1% Linearity	0 – 10mv
Surface PAR	Biospherical	QSR-240P	400-700nm 1.4e-5uE/(cm2-sec) to 0.5uE/(cm2-sec)	Not Specified	0 - 5VDC

2.1 Underway water measurement sensors used on SIO vessels

TYPE	MFG	Model	Range	Accuracy	Output
Thermosalinograph	Seabird	SBE-21	Temp –5 to +35 C Cond 0 to 65 mS/cm	+/- 0.01 Deg C +/- 0.01 mS/cm	RS232
Thermosalinograph	Seabird	SBE-45	Temp –5 to +35 C Cond 0 to 70 mS/cm	+/- 0.002 Deg C +/- 0.003 mS/cm	RS232
Thermosalinograph	FSI	OTM OCM	Temp –2 to +32 C Cond 0 to 70 mS/cm	+/- 0.003 Deg C +/- 0.005 mS/cm	RS485
Fluorometer	Wetlabs	WetStar	0.03 to 75 ug/l	Not Specified	0 - 5VDC
Water Temperature	Omega	ON-403-PP	Temp –5 to +35 C	+/- 0.02 Deg C	0 - 5VDC
Oxygen	Seabird	SBE-43	120% surf saturation	2%	0 - 5VDC
Hull mounted Sea Surf Temp	STS	SEG-14	Temp –2 to +35 C	+/- 0.1 Deg C	RS232
Flow Meter	Signet	515-PO	0-80 GPM	+/- 1.0% FS	Pulse Count
Flow Meter	FLO-CAT	C-ES45-B002	0.27 – 18.9 LPM	+/- 1.0% FS	Pulse Count
Flow Meter	FLO-CAT	C-ES45-B003	0.38 – 37.9 LPM	+/- 1.0% FS	Pulse Count
Flow Meter	FLO-CAT	C-ES45-B004	0.75 – 75 LPM	+/- 1.0% FS	Pulse Count

3. R/V New Horizon

Current MET configuration:
Meteorological Sensors on Top bridge forward rail
Thermosalinograph in aft lab
Sea Surface Temperature sensors (Hull mounted)
GPS Pcode
Gyro
Knudsen Water Depth

Distance from Mean Water Line to sensors - About 36'

3.1 Sensors located on forward part of the upper bridge

Type	MFG	Model	Range	Accuracy	Output
Air Temperature	RM Young	41342LC	-50.0 to +50.0 C	+/- 0.3 Deg C	4-20 ma
Wind	RM Young	05103	Dir 0-360 Deg Spd 0-60 m/s	+/- 3.0 Deg +/- 0.3 m/s	Voltage Out Pulse Count
Wind	Vaisala	WS425	Dir 0-360 Deg Spd 0-65 m/s	+/- 2.0 Deg +/- 0.14 m/s	RS232
Humidity Temperature	**Vaisala	HMP45A	RH 0-100% Temp –40 to +60 C	+/-1.0% +/- 0.2 Deg C	0 – 1VDC 0 – 1 VDC
Barometer	Vaisala	PTB101C	900-1100 mb	+/- 0.3 mb	0 – 2.5VDC
Radiometer Long Wave	Eppley	PIR	3.5-50 um 4 uv/W/M2	+/- 1% Linearity	0 – 10mv
Radiometer Short Wave	Eppley	PSP	285-2800nm 9 uv/W/M2	+/- 0.5% Linearity	0 – 100mv
* Surface PAR	Biospherical	QSR-240P	400-700nm 1.4e-5uE/(cm2-sec) to 0.5uE/(cm2-sec)	Not Specified	0 - 5VDC

All above sensors plug into a MET Sensor junction box that utilizes analog to RS485 converters as well as RS232 to RS485 converters.

The Mast Junction box is SEG Type 8B and can accommodate the following number of sensor types.
1 RM Young Anemometer connection
2 RS485 connections
1 RS232 input
7 Analog voltage inputs
2 Analog 4-20ma inputs

Air Temperature and Humidity sensors are installed in a multi-plate radiation shield (RM Young 41002).
The Barometer utilizes a static pressure head – Vaisala SPH-10

** The Humidity/temperature sensor is typically the Vaisala HMP-45A. On occasion the Rotronics MP101A may replace it.

3.2 Sensors located in Aft Lab:

TYPE	MFG	Model	Range	Accuracy	OutPut
*Thermosalinograph	Seabird	SBE-21	Temp –5 to +35 Deg C Cond 0 to 65 mS/cm	+/- 0.01 Deg C +/- 0.01 mS/cm	RS232
* Fluorometer	Wetlabs	WetStar	0.03 to 75 ug/l	Not Specified	0 – 5VDC
Flow Meter	FLO-CAT	C-ES45-B004	0.75 – 75 LPM	+/- 1.0% FS	Pulse Count

The Fluorometer signal is connected to one of the 4 channels A/D built into the SBE-21. The SBE-21 RS232 output is connected to the main MET Acquisition computer.

3.3 Hull Mounted Sensors

TYPE	MFG	Model	Range	Accuracy	Output
Hull mounted Sea Surface Temp	STS	SEG-14	Temp –2 to +35 Deg C	+/- 0.1 DegC	RS485

These sensors are located in the machine shop compartment, starboard side, between the hull and insulation.

The RS485 Output is connected to the main MET Acquisition computer.

* Installed upon request prior to cruise

4. R/V Sproul

Current MET configuration:
Meteorological Sensors on Flying bridge
GPS Pcode
Gyro
Knudsen Water Depth

A description of the sensors that are on the R/V Sproul follows:
Coastal Environmental WeatherPak, Sample rate once every 10 seconds
Location: Top bridge Deck

Distance Sensors Mounted above Top Bridge Deck - about 7'
Distance from Mean Water Line to sensors - About 33'

4.1 Sensors located on top bridge deck

Type	MFG	Model	Range	Accuracy	Output
Weather station	Coastal Environmental	Weatherpak			RS232
Wind	RM Young	05103	Dir 0-360 Deg Spd 0-60 m/s	+/- 3.0 Deg +/- 0.3 m/s	Weatherpak
Barometer	Coastal Environmental	1081	300-1100mb	+/- 1mb	Weatherpak
Humidity/Temp	Vaisala	HMP45A	RH 0-100% Temp –40 to +60 C	+/-1.0% +/- 0.2 Deg C	Weatherpak
Radiometer Long Wave	Eppley	PIR	3.5-50 um 4 uv/W/M2	+/- 1% Linearity	Weatherpak
Radiometer Black&White	Eppley	8-48	285-2800nm 10 uv/W/M2	+/- 1% Linearity	Weatherpak

All above sensors plug into the Weatherpak. The RS232 output of the weatherpak feeds the main MET acquisition computer located in the upper Lab van.

Air Temperature and Humidity sensors are installed in a multi-plate radiation shield (RM Young 41002).

5. R/V Revelle

Meteorological Sensors on Forward MET Mast
Thermosalinograph Sensors in Bow Thruster Room
Flo-thru Sensors in Aft Hydro lab
Wind Sensors on Main Mast
Timeserver for precision Time Stamping of data
GPS Pcode for Ships position
Sperry MK37 Gyro or TSS Meridian Surveyor for ships heading
Knudsen Water Depth

MET system outputs:
Sound Velocity to EM120 Simrad Multibeam system

The following Sensors are mounted on the Forward MET mast.
There are two levels.

1. First Platform - 56'above Mean Water Line.
2. Second Platform - 68' above Mean Water Line

5.1 Sensors located on Forward MET Mast:

Type	MFG	Model	Range	Accuracy	Output	MWL
Air Temp	RM Young	41342LC	-50.0 to +50.0 C	+/- 0.3 Deg C	4-20 ma	57'
Precipitation	RM Young	50202	0-50 mm	+/- 1.0 mm	0 - 5 Volts	57'
Wind	RM Young	05103	Dir 0-360 Deg Spd 0-60 m/s	+/- 3.0 Deg +/- 0.3 m/s	Volts Pulse Count	59'
Wind	Vaisala	WS425	Dir 0-360 Deg Spd 0-65 m/s	+/- 2.0 Deg +/- 0.14 m/s	RS232	59'
Humidity Temperature	**Vaisala	HMP45A	RH 0-100% Tmp –40 to +60 C	+/-1.0% +/- 0.2 Deg C	0 – 1 VDC 0 – 1 VDC	57'
Barometer	**Air Inc.	DB-2A	800-1060mb	+/- 0.5 mb	RS232	57'
Barometer	Vaisala	PTB101 C	900-1100 mb	+/- 0.3 mb	0 - 2.5VDC	57'
Radiometer Long Wave	Eppley	PIR	3.5-50 um 4 uv/W/M2	+/- 1% Linearity	0 – 10mv	68'
Radiometer Short Wave	Eppley	PSP	285-2800nm 9 uv/W/M2	+/- 0.5% Linearity	0 – 100mv	68'
* Surface PAR	Biospherical	QSR-240P	400-700nm 1.4e-5uE/(cm2-sec) to 0.5uE/(cm2-sec)	Not Specified	0 - 5VDC	68'

All above sensors plug into a MET Sensor junction box that utilizes analog to RS485 converters as well as RS232 to RS485 converters. A four-conductor cable coming from the Bos'n locker connects the RS485 feed to the SIS cable system, which is then connected to the main MET acquisition computer.

The Mast Junction box is SEG Type 8A and can accommodate the following number of sensor types.
1 RM Young Anemometer connection
4 RS485 connections, 2 RS232 inputs
7 Analog voltage inputs, 4 Analog 4-20ma inputs

Air Temperature and Humidity sensors are installed in a multi-plate radiation shield (RM Young 41002). The Barometer utilizes a static pressure head – Vaisala SPH-10

** The Humidity/temperature sensor is typically the Vaisala HMP-45A. On occasion the Rotronics MP101A may replace it. The barometer is typically the AIR Inc DB-2A but on some occasions the Vaisala PTB-100A or PTB-101C may replace it.
* Installed upon request prior to cruise

5.2 Sensors located in Aft Hydro LAB:

Uncontaminated Seawater from bow feeds a vortex debubbler. The debubbled water is then fed into the flo-thru system.

Flo-thru System

TYPE	MFG	Model	Range	Accuracy	Output
Fluorometer	Wetlabs	WetStar	0.03 to 75 ug/l	Not Specified	0 - 5VDC
Water Temperature	Omega	ON-403-PP	Temp –5 to +35 C	+/- 0.02 Deg C	0 - 5VDC
Oxygen	Seabird	SBE-43	120% surf saturation	2%	0 - 5VDC
FlowMeter	FLO-CAT	C-ES45-B003	0.38 – 37.9 LPM	+/- 1.0 % FS	Pulse Count
* Thermosalinograph	Seabird	SBE-45	Temp –5 to +35 C Cond 0 to 70 mS/cm	+/- 0.002 Deg C +/- 0.003 mS/cm	RS232

The above sensors plug into a Sensor junction box that utilizes analog to RS485 converters. The RS485 feed connects via the SIS system to the Main MET acquisition computer in computer Lab.

5.3 Sensors located in Bow Thruster Room

TYPE	MFG	Model	Range	Accuracy	Output
Thermosalinograph	Seabird	SBE-45	Temp –5 to +35 C Cond 0 to 70 mS/cm	+/- 0.002 Deg C +/- 0.003 mS/cm	RS232
Flow Meter	Flocat	C-ES45-B002	0.27 – 18.9 LPM	+/- 1.0% FS	Pulse Count

The Thermosalinograph is located about 7’ from the seawater intake.

An LCD panel provides a local readout for Sea Surface Temperature, Salinity and water flow in the uncontaminated seawater supply.

* Installed upon request prior to cruise

6. R/V Melville

Current MET configuration:
Meteorological Sensors on Forward MET Mast
Thermosalinograph Sensors in Bow Chamber
Flo-thru Sensors in Analytical Lab
Timeserver for precision Time Stamping of data
GPS Pcode
Sperry MK37 Gyro
Knudsen Depth

MET system outputs:
Navigation string to Seabeam 2000
RS232 data out to main lab splitter

The following Sensors are mounted on the forward mast at a location 55' above the mean water line:

6.1 Sensors located on Forward MET Mast

Type	MFG	Model	Range	Accuracy	Output
Air Temp	RM Young	41342LC	-50.0 to +50.0 C	+/- 0.3 Deg C	4-20 ma
Precipitation	RM Young	50202	0-50 mm	+/- 1.0 mm	0 - 5 Volts
Wind	Vaisala	WS425	Dir 0-360 Deg Spd 0-65 m/s	+/- 2.0 Deg +/- 0.14 m/s	RS232
Humidity/Temp	Vaisala	HMP45A	RH 0-100% Tmp –40 to +60 C	+/-1.0% +/- 0.2 Deg C	0 – 1 VDC 0 – 1 VDC
Barometer	Vaisala	PTB101C	900-1100 mb	+/- 0.3 mb	0 - 2.5VDC
Radiometer Long Wave	Eppley	PIR	3.5-50 um 4 uv/W/M2	+/- 1% Linearity	0 – 10mv
Radiometer Short Wave	Eppley	PSP	285-2800nm 9 uv/W/M2	+/- 0.5% Linearity	0 – 100mv
* Surface PAR	Biospherical	QSR-240P	400-700nm 1.4e-5uE/(cm2-sec) to 0.5uE/(cm2-sec)	Not Specified	0 - 5VDC

All above sensors plug into a MET Sensor junction box that utilizes analog to RS485 converters as well as RS232 to RS485 converters. A four-conductor cable coming from the Bos'n locker connects the RS485 feed to the SIS cable system, which is then connected to the main MET acquisition computer.

The Mast Junction box is SEG Type 8B and can accommodate the following number of sensor types.
1 RM Young Anemometer connection
2 RS485 connections, 1 RS232 input
7 Analog voltage inputs, 2 Analog 4-20ma inputs

Air Temperature and Humidity sensors are installed in a multi-plate radiation shield (RM Young 41002). The Barometer utilizes a static pressure head – Vaisala SPH-10

** The Humidity/temperature sensor is typically the Vaisala HMP-45A. On occasion the Rotronics MP101A may replace it. The barometer is typically the Vaisala PTB-101C but on some occasions it may be replaced by the AIR Inc. DB-2A.
* Installed upon request prior to cruise

6.2 Sensors located in Bio/Analytical Lab

Flo-thru System

TYPE	MFG	Model	Range	Accuracy	Output
Fluorometer	Wetlabs	WetStar	0.03 to 75 ug/l	Not Specified	0 - 5VDC
Water Temperature	Omega	ON-403-PP	Temp –5 to +35 C	+/- 0.02 Deg C	0 - 5VDC
Oxygen	Seabird	SBE-43	120% surf saturation	2%	0 - 5VDC
FlowMeter	FLO-CAT	C-ES45-B003	0.38 – 37.9 LPM	+/- 1.0% FS	Pulse Count
* Thermosalinograph	Seabird	SBE-45	Temp –5 to +35 C Cond 0 to 70 mS/cm	+/- 0.002 Deg C +/- 0.003 mS/cm	RS232

The above sensors plug into a Sensor junction box that utilizes analog to RS485 converters. The RS485 feed connects to the Main MET acquisition computer in computer Lab.

6.3 Sensors located in Bow Chamber

TYPE	MFG	Model	Range	Accuracy	Output
Thermosalinograph	FSI	OTM OCM	Temp –2 to +32 C Cond 0 to 70 mS/cm	+/- 0.003 Deg C +/- 0.003 mS/cm	RS485
Flow Meter	Signet	515-PO	0-80GPM	+/- 1.0 % FS	Pulse Count

TYPE	MFG	Model	Range	Accuracy	Output
Thermosalinograph	Seabird	SBE-45	Temp –5 to +35 C Cond 0 to 70 mS/cm	+/- 0.002 Deg C +/- 0.003 mS/cm	RS232
Flow Meter	Flocat	C-ES45-B002	0.27 – 18.9 LPM	+/- 1.0% FS	Pulse Count

The SBE45 Thermosalinograph is located about 10’ from the seawater intake.

The above sensors plug into a Sensor junction box. The RS485 feed connects to the Main MET acquisition computer in computer Lab.

* Installed upon request prior to cruise